

Health Consultation

SENTINEL WOOD TREATING COMPANY INCORPORATED

EVALUATION OF OFF-SITE CONTAMINATION INTO THE
UNNAMED TRIBUTARY OF PRAIRIE CREEK

AVA, DOUGLAS COUNTY, MISSOURI

EPA FACILITY ID: MOD029684438

FEBRUARY 23, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

Missouri Department of Health and Senior Services
Section for Environmental Public Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Statement of Issues and Background

Statement of Issues

The U.S. Environmental Protection Agency (EPA), through the Agency for Toxic Substances and Disease Registry (ATSDR) regional office, asked the Missouri Department of Health and Senior Services (DHSS) to complete a health consultation for the unnamed tributary to Prairie Creek. The tributary drains from the Sentinel Wood Treating, Incorporated (Sentinel) site, the 12th Avenue Solvents site, and the Community Laundromat site, in Ava, Missouri. This health consultation examines contaminant concentrations, exposure potential, and the corresponding threat to public health.

Background

Ava, Douglas County, Missouri, is approximately 55 miles southeast of Springfield, Missouri. It is a small town with an estimated population of 2,938 residents. In Ava, three hazardous waste sites are located on the north side of 12th Avenue, which is also known as State Route 14 and Business Highway 5. These contaminated sites have the potential to affect an off-site area south of 12th Avenue that surrounds the unnamed tributary to Prairie Creek (Figure 1). The sites are the Sentinel Wood Treating site, 12th Avenue Solvents site, and the Community Laundromat site (Figure 2).

The unnamed tributary to Prairie Creek begins as two unnamed streams come together at the northern edge of the Sentinel site. The resulting stream flows across the property, under 12th Avenue, through first a sparsely populated residential area, then a city park, and ultimately into Prairie Creek (1). A small wetland area immediately south of 12th Avenue and east of the unnamed tributary also flows into the unnamed tributary further downstream.

The unnamed tributary to Prairie Creek is a gaining and losing stream at various points along its course, depending on the time of year and the amount of precipitation. It may cease flow during dry periods, but maintains permanent pools that support aquatic life. According to the residents of Ava, children use the unnamed tributary of Prairie Creek for recreational purposes. No fishing was reported to take place in the streams. Prairie Creek joins Cowskin Creek and ultimately flows into Beaver Creek, approximately 5 miles from 12th Avenue. No sensitive (threatened or endangered) species or communities have been identified along the unnamed tributary or Prairie Creek (2). Reportedly, no private wells are in use within the city limits and all residences within a mile of the site are connected to city water lines (1).

The Sentinel site is located at 412 NW 12th Avenue in Ava (Figure 1). The site is approximately 15 acres in size and is located in a mixed industrial, commercial, agricultural, and residential area of the city. Several commercial establishments have been developed on the site and in the surrounding area (1).

The Sentinel Wood Treating facility operated at this site from 1959 until the late 1980s. Until 1978, the facility pressure treated wood with pentachlorophenol (PCP). The resulting sludge was

either burned on-site in a boiler or deposited in one of three lagoons. The lagoons are located on the northern edge of the site and were closed in 1978–1979, when the pressure treating operations ceased at the facility (1).

The company began manufacturing hog houses in 1975 and portable and/or outdoor wood furniture in 1980. The hog houses and furniture were built from lumber treated with copper, chromium, and arsenic (CCA). CCA treatment of lumber was not applied on-site; however, the sawdust and scrap wood from construction was burned in an on-site industrial furnace. In the late 1980s, all operations ceased at the site (1). The contamination at the Sentinel Wood Treating site and potential human exposure are discussed in a separate health consultation by DHSS that was published on April 27, 2004.

The properties north of the Sentinel site are private farms used for pastureland. Two ponds were located immediately north of the site. In 2002, the ponds were partially drained so a new road could be constructed just north of the ponds.

A second site, the 12th Avenue Solvents site, is another source of contamination for the unnamed tributary to Prairie Creek (3). The 12th Avenue Solvents site is also located north of 12th Avenue and east of the Sentinel site (Figure 2). The eastern boundary is 3rd Street (3). To the south of the site and 12th Avenue is the Douglas County Health Department (DCHD) and a small wetland area. Two businesses, Rawlings and Copeland, are located at the 12th Avenue Solvents site. The Rawlings Sporting Goods Company manufactured sporting equipment at this location until approximately 1973. The Copeland manufacturing facility is a wholly owned subsidiary of Emerson Electric. Emerson Electric operated at the site before 1997, manufacturing and assembling commercial and industrial electric motors using benzene, toluene, ethylbenzene, and xylene. Since 1997, the Copeland Corporation has been machining cast iron parts for manufacturing of scroll compressors. Contaminated soil and groundwater have been found in this area in the past. Contamination at the 12th Avenue site and potential human exposure are currently being reviewed by DHSS and ATSDR and will be discussed in a separate health consultation once the review is complete.

Southeast of the 12th Avenue Solvents site is the Community Laundromat site. It is located at 306 NW 12th Avenue (Figure 2). The Community Laundromat was a coin-operated public laundry facility. Dry cleaning operations that used tetrachloroethylene (PCE) were also located at the site from 1987 until 1995. In groundwater, PCE can degrade into trichloroethylene (TCE), which in turn degrades to vinyl chloride. PCE and its degradation products were found in groundwater samples from the area surrounding the Community Laundromat. The contamination at the Community Laundromat site and potential human exposure are being investigated and will be discussed in a separate health consultation by DHSS.

South of 12th Avenue, across from the 12th Avenue Solvents site and the Community Laundromat, is a water treatment system operated by Emerson Electric. This system collects surface water from the wetland area, treats it, and discharges it into the creek. It monitors and records the levels of contaminants in the water coming into the treatment system (influent) and in the treated water being discharged (effluent) into the unnamed tributary. The treatment system does not collect water that is flowing directly south from the Sentinel site.

Site Investigations

Numerous investigations have occurred at the Sentinel site, 12th Avenue Solvents site, Community Laundromat site, and the surrounding area. Results of these investigations have been used to determine the nature and extent of contamination at the sites and the migration of contaminants off-site, to evaluate the associated risk to public health, and to help select remedial alternatives.

The unnamed tributary to Prairie Creek that converges on the Sentinel site and runs through the city of Ava has been monitored for contaminants in the sediment and water at several locations over the past several years. In December 2001, the Missouri Department of Health and Senior Services (DHSS) prepared a Health Consultation that discussed off-site contamination in the unnamed tributary. The DHSS determined that exposures to contaminants migrating from the Sentinel site posed a *Public Health Hazard* in the off-site area of the unnamed tributary (3). This health hazard category was based on the following conclusions:

- Dioxins in creek sediments were at levels of health concern, especially for children and sensitive populations. Historically, PCP in the unnamed tributary to Prairie Creek may have been at levels that could have caused adverse health effects. Limitations in the data prohibited definite determinations to be made about what levels of exposures occurred or if adverse health effects from historic exposures are likely (3).
- At the time of the 2001 Health Consultation, data indicated that the unnamed tributary to Prairie Creek may have received groundwater from areas known to have PCP and VOC contamination (3).
- The potential for continued off-site contamination from the Sentinel and 12th Avenue Solvents sites still existed. The karst geology in the area could allow for the acceleration of contaminant migration and significantly impact private and public drinking water supplies (3).

Since the publication of the December 2001 Health Consultation, several additional investigations have been completed. In September 2002, the Missouri Department of Natural Resources (MDNR) released an expanded site inspection report outlining the results of sampling activities from October 2000 through May 2001. In 2001, EPA conducted a removal site evaluation at the site to assess potential soil and sediment contamination of the unnamed tributary. In early 2003, EPA resampled sediment in the unnamed tributary to determine whether the contaminants associated with the Sentinel site had further affected the stream.

During the MDNR 2001 sampling activity, surface water samples were taken along the unnamed tributary to Prairie Creek at several locations. See Figure 3 for a diagram of the sampling locations. The sampling locations showing sampling values of concern were closest to 12th Avenue, labeled as SW-04, SW-07, SW-08, SW-09, and SW-10.

ATSDR has developed *comparison values* (CVs), such as *minimal risk levels* (MRLs) and *environmental media evaluation guides* (EMEGs), which are media-specific concentrations used

to determine contaminants of concern. Contaminant concentrations that are less than the CV are unlikely to pose a health threat. Contaminant levels above the CV do not necessarily indicate that a health threat is present, but that further evaluation of the chemical and potential exposure pathways is needed.

More specifically, ATSDR MRLs are defined as an estimate of daily human exposure to a substance that is likely to be without a significant risk of adverse health effects over a specified period of exposure. It is a risk-based value for non-cancerous health effects only. EMEGs are media specific comparison values based on the amount of contaminated soil or water that an individual ingests per day. EPA's *maximum contaminant level* (MCL) is the maximum concentration of a chemical allowed by EPA in public drinking water. After comparing contaminant levels detected during sampling to ATSDR CVs or MCLs, the contaminants of concern were total xylenes; pentachlorophenol (PCP); 1,1-dichloroethane; ethylbenzene; toluene; cis-1,2 dichloroethene; and 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD, presented as 2,3,7,8 TCDD toxic equivalents (TEQs) and referred to as dioxin]. Sampling results from locations farther downstream were either below background levels or ATSDR's CVs and not expected to be of concern. See Table 1 for a listing of the sampling results.

In 2001, EPA conducted a removal site evaluation at the site to assess potential contamination of the unnamed tributary. In August 2002, a report was produced listing sediment and soil sampling results from 2001, titled "Removal Site Evaluation for Offsite Sediment and Soil Sampling, Sentinel Wood Treaters Site, Ava, Missouri." This report concluded that the Sentinel site is a source of dioxin contamination for the unnamed tributary. However, the levels of dioxin found in the soil and sediment samples were all below 1 microgram per kilogram ($\mu\text{g/kg}$), a removal action level used by EPA at other sites in this region. The report also states that the site is a source of polycyclic aromatic hydrocarbons (PAHs) benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3,cd)pyrene, all of which were found in the unnamed tributary. As previous sampling has shown, the highest values of these contaminants are found nearest to the site. The levels of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3,cd)pyrene found in the soil and sediment samples closest to 12th Avenue exceeded the MDNR Cleanup Levels for Missouri (CALM) values. The CALM values are risk-based soil and groundwater cleanup levels for sites contaminated with hazardous substances. The cleanup levels are designed to be protective of human health and the environment, and reflect the land use and varied human exposure those uses imply. PCP was not reported above the detection levels in any of the soil samples (4).

The two ponds located immediately north of the Sentinel site were partially drained to allow for the construction of a new road in the fall of 2002. According to witnesses, the release of water from the ponds caused the stream to overflow its banks, potentially flushing contaminants downstream. Consequently, in early 2003, EPA resampled the unnamed tributary to determine whether the contaminants associated with the Sentinel site had further affected the soil and sediment in the unnamed tributary (5). Soil and sediment samples were collected, starting at the most downstream location and progressing upstream toward the Sentinel site. The sampling results confirmed that the Sentinel site appears to be a potential source of off-site dioxin and PAH contamination in the stream. However, contaminant concentrations were actually lower than levels found in the previous sampling performed in 2002, indicating that draining the ponds

did not further affect the stream. Only one sample contained levels of benzo(a)anthracene, benzo(a)pyrene, and benzo(b) fluoranthene that exceeded the CALM values for those compounds. The values were also significantly lower in the second sampling activity than the first. No samples contained levels of dibenz(a,h)anthracene or indeno(1,2,3,cd)pyrene that exceeded the CALM values. See Table 2 and 3 to compare the results from the two sampling events (4, 5). Figure 4 is a map of the sampling locations.

The Sentinel Wood Treating Company conducted surface water sampling for PCP along the unnamed tributary in May, August, September, and December of 2002. As in the previous sampling events, the highest contaminant concentrations are closest to 12th Avenue. At the sampling location closest to 12th Avenue, the highest PCP level of 240 micrograms per liter ($\mu\text{g/L}$) was recorded in the August and September sampling (6). In December, the concentration at that location was 102 $\mu\text{g/L}$. The MCL for PCP is 1 $\mu\text{g/L}$. The ATSDR EMEG for PCP for intermediate exposure is 10 $\mu\text{g/L}$ for children and 40 $\mu\text{g/L}$ for adults. Intermediate exposure is exposure that occurs for more than 14 days but less than 1 year. See Table 4 for a complete list of the sampling results from this sampling event. Figure 5 is a map of the sampling locations.

Since 2003, as part of the Administrative Order on Consent (AOC) between EPA, MDNR, and Emerson Electric, surface water in the area across from the 12th Avenue Solvents site is monitored and processed through a water treatment system. The treatment system removes contaminants from the surface water that are migrating from the 12th Avenue Solvents and Community Laundromat sites. This has significantly reduced the contaminants entering the unnamed tributary. Sampling results, included as part of the December 2003 monthly report from Emerson Electric, indicated that contaminant levels in the influent are still elevated (7). However, because of Emerson Electric's water treatment, levels of most contaminants in the effluent that flows into the unnamed tributary are below detectable levels. In December 2003, vinyl chloride levels were elevated in the influent and effluent. The carbon vessel that treats for vinyl chloride needed to be replaced. This problem was resolved in January 2004 with replacement of the carbon vessel. Emerson Electric's surface water sampling in the portion of the unnamed tributary that flows south from the Sentinel site continued to show elevated PCP levels, therefore PCP contamination is further evaluated as part of this health consultation. Table 5 lists sampling results. Figure 6 is a map of the sampling locations and treatment system.

Discussion

Water

The unnamed tributary to Prairie Creek does not directly contribute to any drinking water source. The potential risk of exposure is mostly to nearby residents, especially children, who come into contact with the stream near 12th Avenue. Since, most residents in this area have been aware of the contamination at this site for several years, it is not likely than many residents use the creek for recreation.

Although access to the unnamed tributary to Prairie Creek is unrestricted, it is unrealistic to estimate that children in the area have constant direct contact with the tributary every day each

year. If the neighborhood children play there, it is likely to be for short periods on summer days. The minimal amount of water that would be ingested during typical child's play is not expected to cause adverse health effects. However, because the PCP levels in the water exceed MCLs, the water from the unnamed tributary to Prairie Creek should not be used as a drinking water source.

Soil/Sediment

Contaminants of concern from the 2003 sampling results are the PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3,cd)pyrene. In the period between the 2002 sampling and the 2003 resampling, levels of these contaminants decreased. Levels present in the 2003 sampling for benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene exceeded the MDNR CALM values for these contaminants. Dibenz(a,h)anthracene and indeno(1,2,3,cd)pyrene were not present at or above detection limits (5).

Exposure to contaminated soil and sediment along the unnamed tributary to Prairie Creek is limited to residents, mainly children who use it for recreational purposes. As stated earlier, residents are aware of the contamination in the area and it is not likely that children play there daily. If children use the unnamed tributary to Prairie Creek for recreation, their contact is likely to be a couple times a year, for short periods. The amount of sediment that children would likely incidentally ingest is minimal and not likely to cause adverse health effects.

Toxicity Information

Pentachlorophenol

Adverse health effects can occur in humans following short-term and long-term exposure to PCP by inhalation, oral, and skin exposure. Direct contact with PCP can irritate the skin, eyes, and mouth. The most common form of exposure to PCP is ingestion of contaminated water.

Short-term exposure to large amounts of PCP or long-term exposure to low levels can harm the gastrointestinal tract, liver, thyroid, kidneys, blood, and lungs. nervous, immune, and reproductive systems and affect normal development. Exposure is also associated with carcinogenic, renal, and neurological effects. There are not sufficient studies to determine if children are more sensitive than adults to the effects from exposure to PCP. The International Agency for Research on Cancer has determined that PCP is a possible carcinogen to humans (9). A possible human carcinogen is a chemical with limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in animals.

PCP is at levels above drinking water standards in the unnamed tributary to Prairie Creek, specifically in the area closest to 12th Avenue. On the basis of those levels found in the unnamed tributary, the estimated consumption of contaminated water from the creek should not cause adverse health effects for acute or intermediate exposures. *Acute exposure* lasts for less than 14 days; *intermediate exposure* lasts for more than 15 days, but less than 1 year. Only *chronic*

exposure, that is exposure that lasts for more than 365 days, would be a problem. Therefore, using the unnamed tributary to Prairie Creek as a drinking water source is not recommended.

Polycyclic Aromatic Hydrocarbons

PAHs found in the sediment samples included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz (a,h)anthracene, and indeno(1,2,3,cd)pyrene. Typical sources of PAHs include asphalt roads, residential wood burning, municipal and industrial waste incineration, and hazardous waste sites. Cigarette smoke, vehicle exhausts, coal, coal tar, wildfires, and agricultural burning are also considered to be sources of PAHs. People can be exposed to PAHs by ingestion, inhalation, or skin contact. Studies in animals have shown that PAHs can cause harmful effects on the skin, body fluids, immune system, and reproductive system, along with birth defects and low birth weight. Similar effects could occur in people; however, no information is available to show that these effects do occur. (10)

EPA has listed benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz (a,h)anthracene, and indeno(1,2,3,cd)pyrene as probable human carcinogens (10). A probable human carcinogen is a chemical that has limited evidence of carcinogenicity in humans, but sufficient evidence of carcinogenicity in animals.

Elevated levels of PAHs are present and prolonged exposure or ingestion of the contaminated sediment is not recommended. The extent and level of contamination of PAHs is declining with time and distance from 12th Avenue in the sediment along the unnamed tributary. Incidental exposure to the sediment should not result in adverse health effects.

Children's Health

In general, children are more likely than adults are to be exposed to contaminants in soil or water. In their daily activities, children tend to have frequent hand-to-mouth contact and introduce nonfood items into their mouths. Because children are smaller and their bodies typically retain more of the contaminants, it usually takes less of a contaminant to cause adverse health effects in children than in adults.

Children who play in the surface water and sediment along the tributary will be exposed to the contaminants through incidental ingestion. Exposure is expected to be infrequent and of short duration. Such minimal contact with the sediment and water should not result in adverse health effects; however, intentional ingestion of the sediment or water is strongly discouraged. To be prudent, children who live along the unnamed tributary should limit contact with the creek and wash hands thoroughly after outdoor activities.

Conclusions

In a previous health consultation, the off-site area, including the unnamed tributary to Prairie Creek, was classified as a *Public Health Hazard* for past exposures to multiple contaminants detected in the unnamed tributary (3). Recent sampling has shown that the Sentinel site is a continuing source of PCP in the unnamed tributary and levels have not decreased dramatically in the past 2 years. Sampling has also shown that elevated levels of PAHs are still present in the sediment above MDNR CALM values. However, because of the treatment processes in place, other contaminants are no longer a concern. Exposure to the contaminated water and sediments is expected to be infrequent and of short duration. Therefore, the off-site area including the unnamed tributary to Prairie Creek is considered *No Apparent Public Health Hazard* for present exposures. These determinations are based on the following:

1. PCP has been found in surface water at levels that exceed ATSDR CVs and the MCL for PCP. However, these screening values are based on levels for drinking water and the unnamed tributary to Prairie Creek is not used as a source for drinking water.
2. Elevated levels of the contaminants of concern in the soil/sediment are located in the area closest to 12th Avenue. Contaminant levels in sediment and soil samples decrease as distance from the site increases. In addition, contaminant levels apparently have decreased over time.
3. Although intentional or prolonged ingestion of the soil or sediments is not expected to occur, PAHs have been found in sediment at levels that exceed MDNR CALM values. Incidental exposure to the sediments is not likely to cause adverse health effects; however, it would be prudent to avoid prolonged exposure or intentional ingestion.

Recommendations

1. Until removal actions are completed, residents should limit contact with the water or sediment in the unnamed tributary near 12th Avenue. Ingestion of water or sediments is not recommended.
2. EPA/DNR/potentially responsible parties should continue to conduct removal actions to mitigate or prevent future exposures, because the Sentinel Wood Treating, 12th Avenue Solvents and Community Laundromat sites are determined to be continuing sources of contamination in the unnamed tributary.
3. Emerson Electric should continue to treat the water in the wetland area that is affected by the 12th Avenue Solvents site.

Public Health Action Plan

This Public Health Action Plan (PHAP) for the Sentinel off-site/unnamed tributary to Prairie Creek area contains an explanation of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substance and Disease Registry (ATSDR) and other stakeholders. The purpose of the PHAP is to ensure that this public health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to hazardous substances at or near the site. Below is a list of commitments of public health actions to be implemented by DHSS, ATSDR, or other stakeholders at the site:

1. DHSS/ATSDR will coordinate with MDNR/EPA, the City of Ava, and the responsible parties to implement the recommendations in this health consultation to eliminate or lessen exposure to the contaminants.
2. DHSS/ATSDR will review additional sampling data as it becomes available and provide guidance regarding possible health risk.
3. DHSS/ATSDR will continue to address community health concerns and questions as needed. Necessary community and health professional education will also be provided to reduce and eliminate exposure to hazardous chemicals and emphasize proper hand washing after outdoor activities.
4. DHSS/ATSDR will update this public health consultation as more information becomes available.

Report Prepared by:

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Missouri Department of Health and Senior Services

Attachments:**Figures**

Figure 1, Hazardous Waste Sites in Ava, Missouri (2)

Figure 2, Map of all Sites Contributing Contamination to the Off-Site Area, Ava, Missouri

Figure 3, Sentinel Wood Treating, Inc Off-Site Area Sampling Location Map (2)

Figure 4, Tetra Tech EM, Inc. Sampling Locations Along the Unnamed Tributary to Prairie Creek (3)

Figure 5, Sentinel Surface Water Sampling Locations in Off-Site Area (6)

Figure 6, Emerson Electric Sampling and Monitoring Locations (7)

Tables

Table 1, Surface Water Sampling Results

Table 2, Sediment and Soil Sampling Results (2002)

Table 3, Sediment and Soil Sampling Results (2003)

Table 4, Surface Water Sampling Results

Table 5, Emerson Electric Water Monitoring Results

References

1. Missouri Department of Health and Senior Services. Health Consultation. 420 NW 12th Avenue. Sentinel Wood Treating Company Incorporated. Jefferson City: Missouri Department of Health and Senior Services; 1998 May 19.
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4. Tetra Tech EM Inc. Removal site evaluation for off-site sediment and soil sampling. Sentinel Wood Treating Site—Ava, Missouri. St. Louis, Missouri. August 19, 2002.
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11. US Geological Survey. Ava, Missouri aerial photo. March 23, 1995. Available at URL: <http://terraser-ver-usa.com>.

Certification

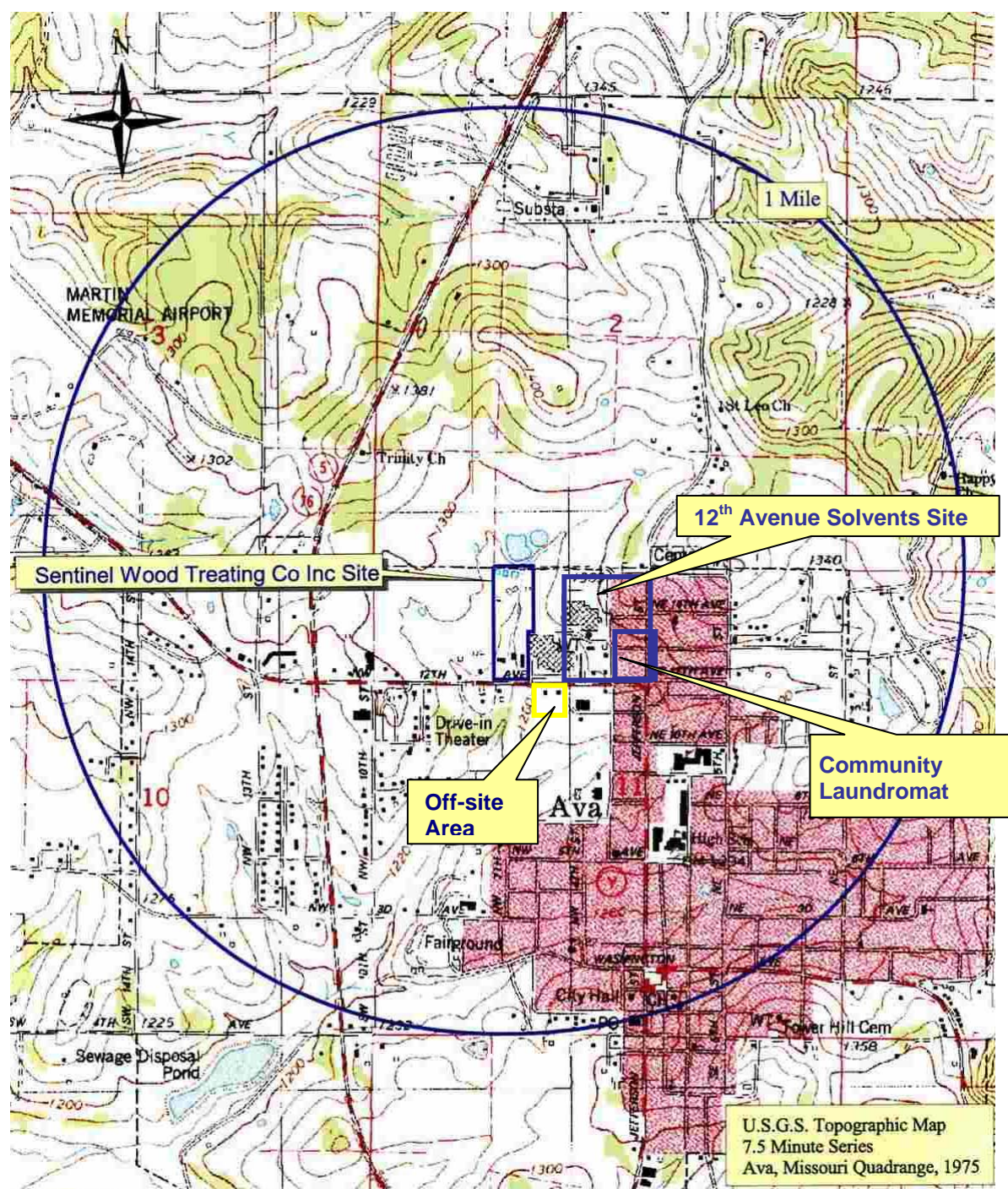
This Evaluation of the Off-Site Contamination into the Unnamed Tributary of Prairie Creek, Sentinel Wood Treating Company, Incorporated Health Consultation was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures; existing at the time this health consultation was initiated.

TPO, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAT, SPAB, DHAC

Figure 1
Hazardous Waste Sites in
Ava, Douglas County, Missouri



Source: Missouri Department of Natural Resources, Sentinel Wood Treating Co, Inc site, Douglas County, Missouri. 2000 September 9.

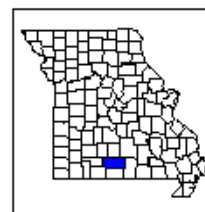
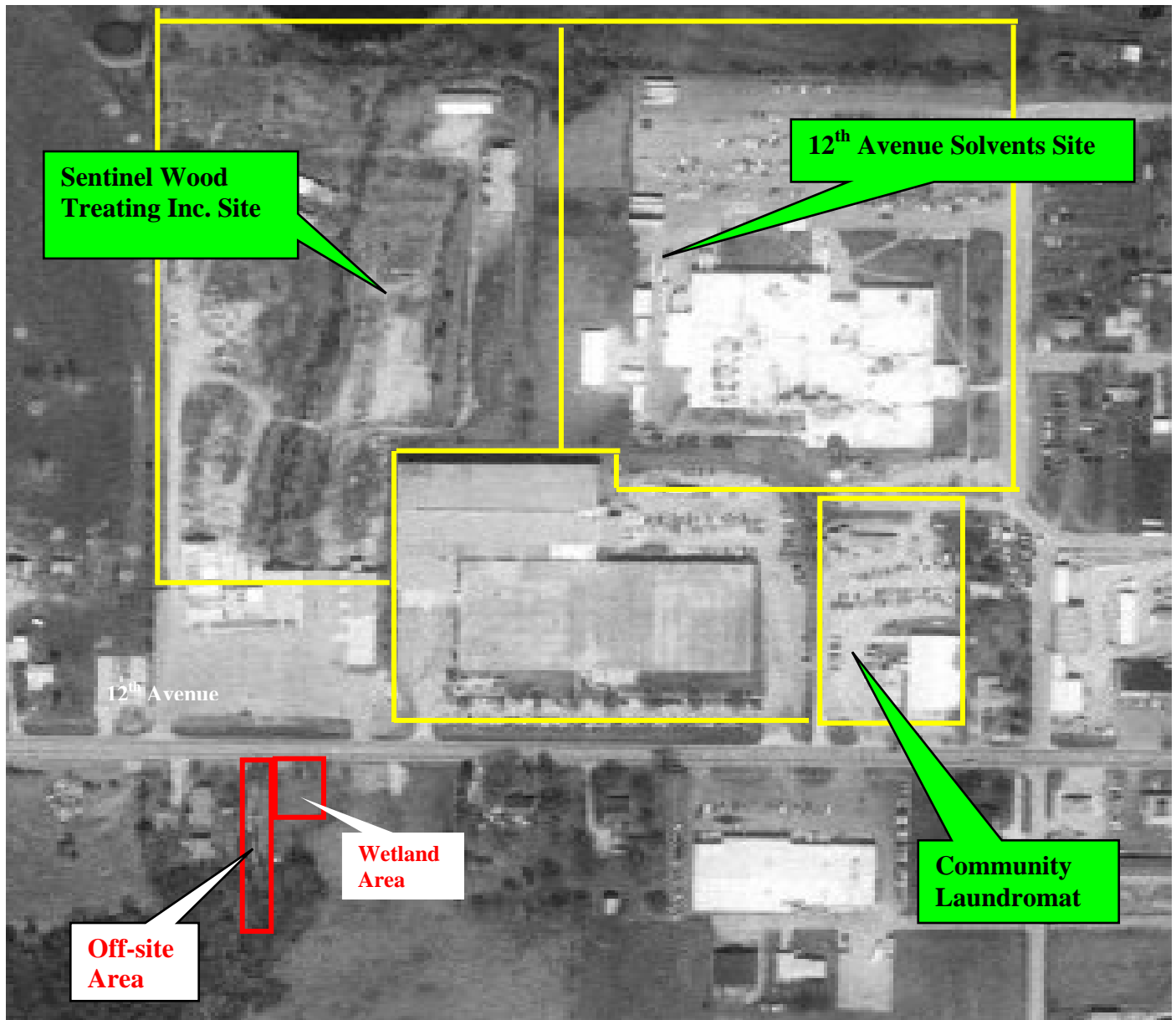


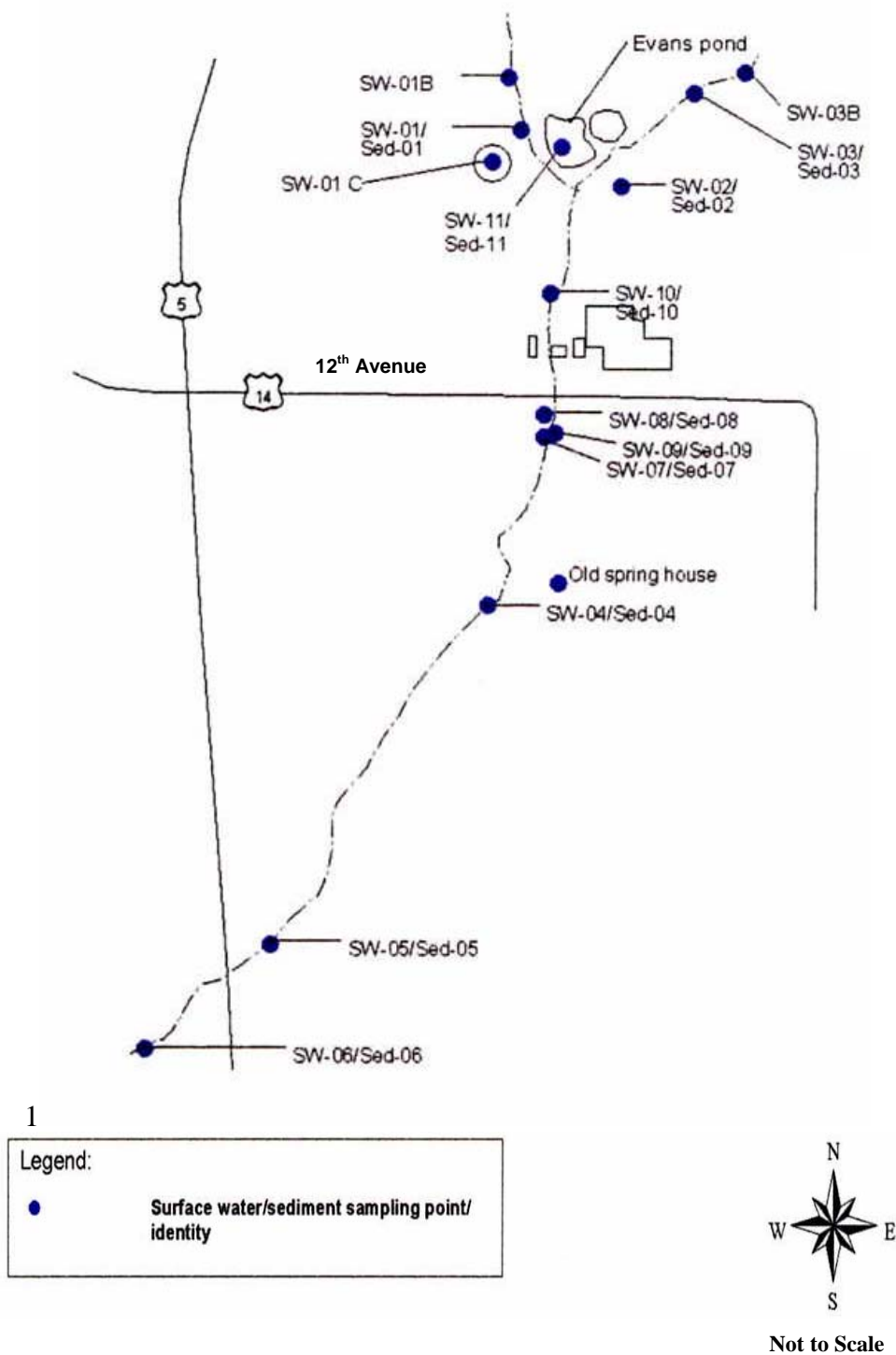
Figure 2
Map of all Sites Contributing Contamination to the Off-Site Area, Ava, Missouri



Source: U.S. Geological Survey; Ava, Missouri aerial photo; March 27, 1995.

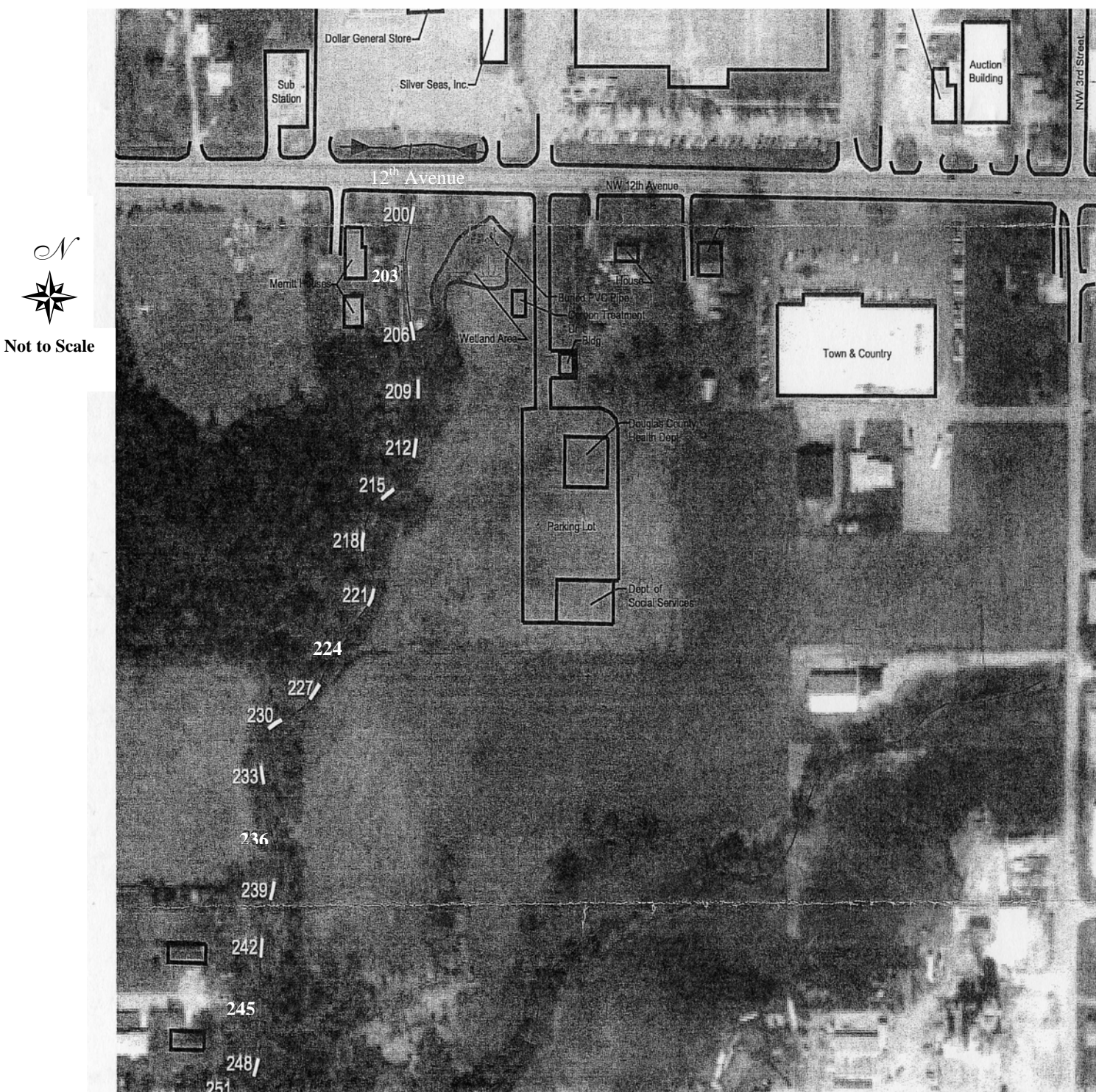


Figure 3
Sentinel Wood Treating, Inc Off-site Sampling Location Map



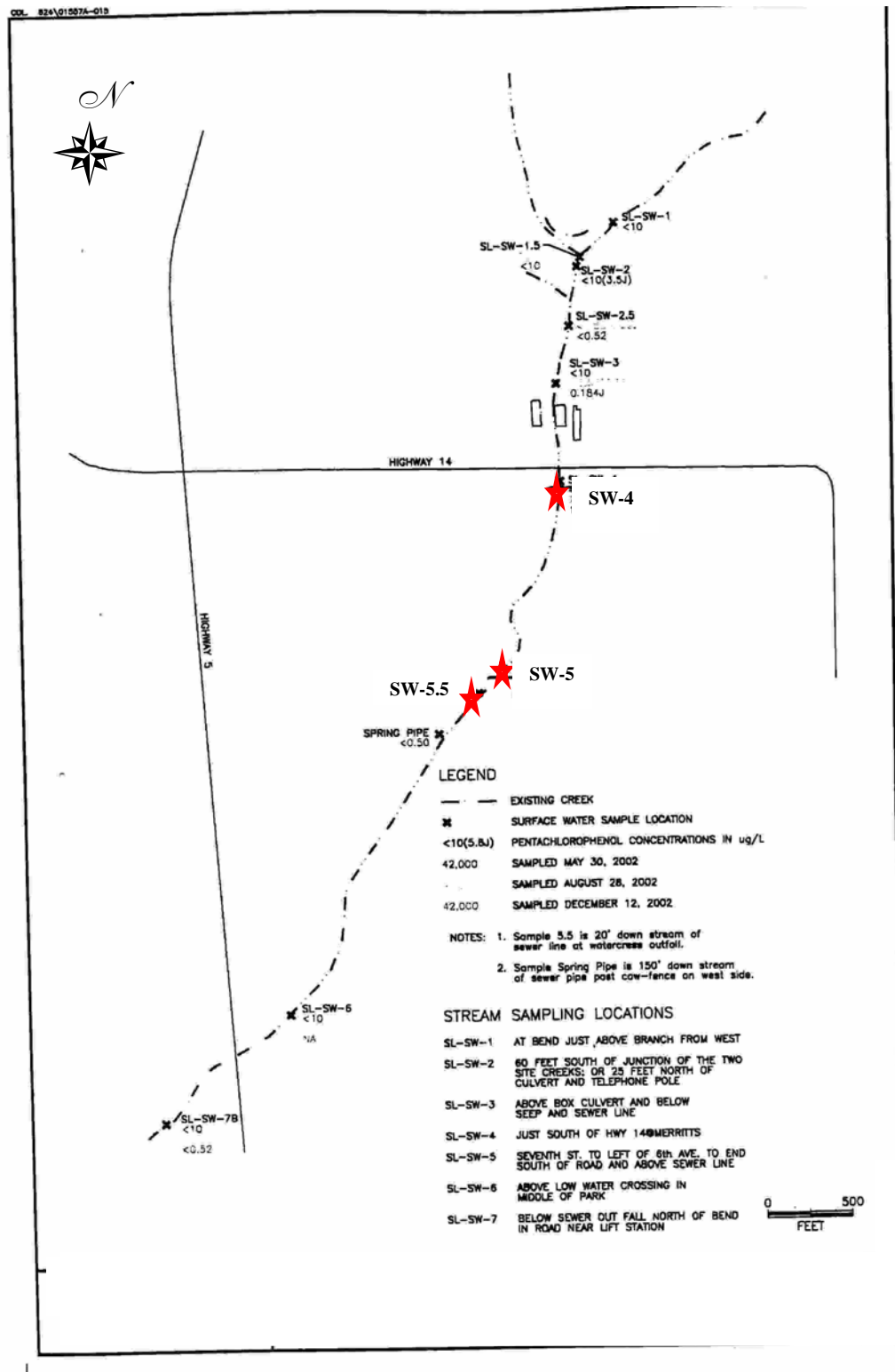
Source: Missouri Department of Natural Resources, Expanded site inspection report, Sentinel Wood Treating site, Douglas County, Missouri . 2000 September 9.

Figure 4
Tetra Tech EM, Inc. Sampling Locations Along the
Unnamed Tributary to Prairie Creek



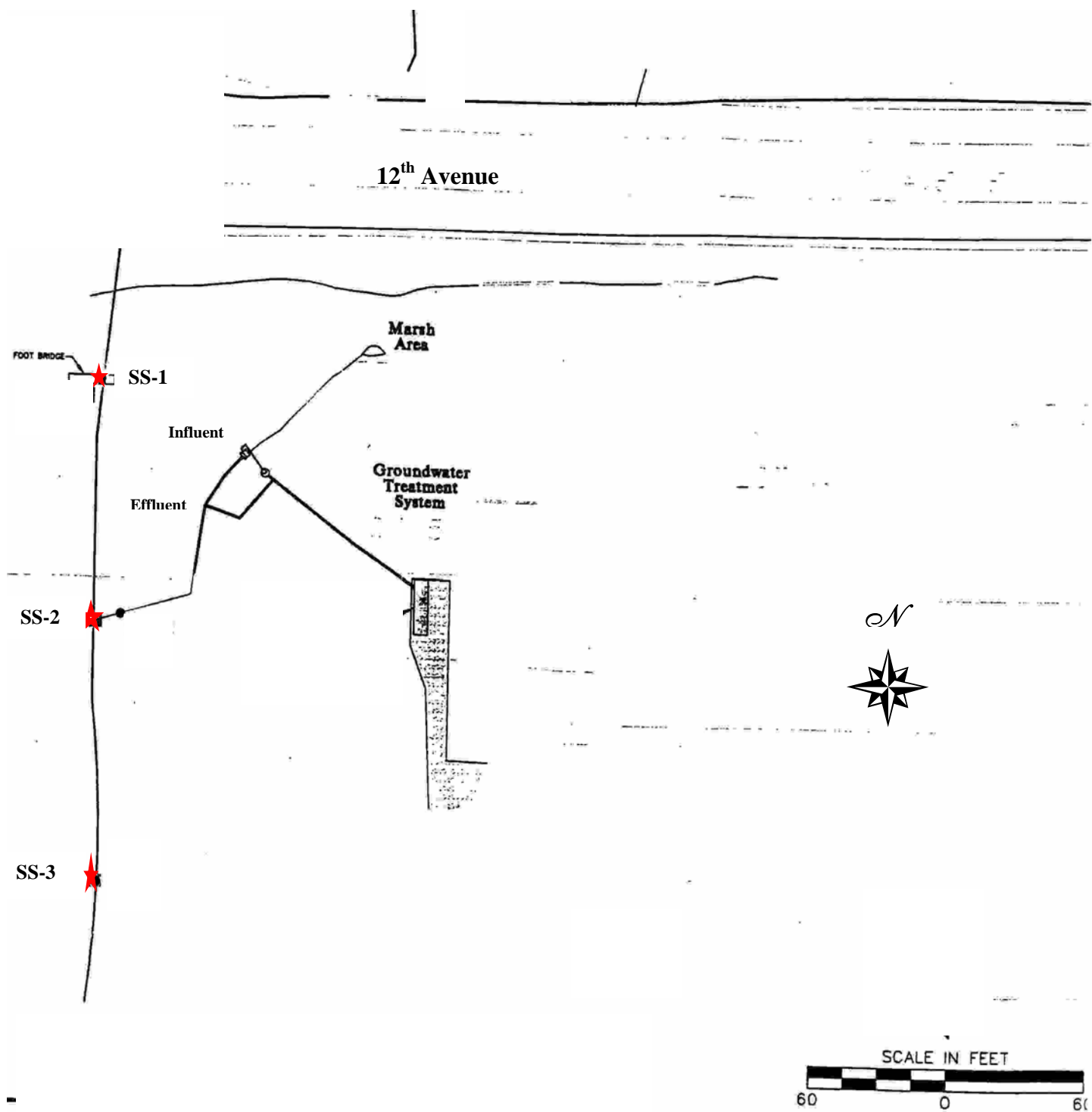
Source: Tetra Tech EM, Inc. Data summary for removal site evaluation follow-up sediment sampling activities at the Sentinel Wood Treaters site—Ava, Missouri. 2003 December 5.

Figure 5
Sentinel Surface Water Sampling Locations in Off-site Area
 (Sampling conducted in 2002)



Source: Sentinel Wood Treatment site, surface waste sample results summary of sampling conducted on May 30, 2002, August 28, 2002, September 12, 2002, and December 12, 2002. Provided by Sentinel Wood Treatment Company.

Figure 6
Emerson Electric Sampling and Monitoring Locations



Source: Environmental Strategies Consulting, LLC. 12th Avenue Solvents site, monthly project status report, Report No.25, December 2003.

Table 1**Surface Water Sampling Results, Unnamed Tributary to Prairie Creek**

(Selected Analytical Results, October 2000-May 2001)

Contaminant	SW-04	SW-07	SW-08	SW-09	SW-10	ATSDR Comparison Values	EPA MCL
VOCs							
1,1 – Dichloroethane	<1.0	18.8	<1.0	51.5	<1.0	9 (Orl, Chronic)*	NA
Cis-1,2-Dichloroethene	4.3	58.6	<1.0	146	<1.0	3000 (Child, Inter)† 10,000 (Adult, Inter)†	70
Ethylbenzene	11.3	4,180	12.8	10,500	<1.0	1,000 (Inh, Inter)*	700
Toluene	<1.0	30.8	<1.0	79.3	<1.0	200 (Child, Inter)† 700 (Adult, Inter)†	1,000
Xylenes, total	67.0	12,900	71.6	27,600	<2.0	2000 (Child, Inter)† 7000 (Adult, Inter)†	10,000
Semi-VOCs							
Pentachlorophenol	8.5	2.4	240	0.3	7.7	10 (Child, Inter)† 40 (Adult, Inter)†	1
2,3,7,8-Dioxin Total Equivalents							
2,3,7,8 TCDD TEQs	0.00000996	0.00000164	0.000021	Not Detected	0.0000204	0.0002 (Child, Inter)† 0.0007 (Adult, Inter)†	0.00000003

All values are in parts per billion (ppb) or micrograms per liter (µg/L).

NA=Not available.

*ATSDR MRL values are categorized by exposure method and duration of exposure. (Inh=Inhalation; Orl=Orally; Acute=contact that occurs only once or for up to 14 days; †ATSDR EMEG values categorized by duration of exposure and by adult or child.

Intermediate=contact that occurs for more than 14 days but less than 1 year; Chronic=contact that occurs for more than 1 year.)

Values in **bold** typeface exceed an ATSDR CV or EPA MCL for acute, intermediate, or chronic exposure.

MCL=Maximum Contaminant Level for drinking water.

Table 2

Sediment and Soil Sampling Results, Unnamed Tributary to Prairie Creek

(Selected Analytical Results, April 2002)

	Sampling Location (Cell ID)										ATSDR CV*	MDNR CALM
Contaminant	254	251	248	245	242	239	236	233	230	227		
Benzo(a)anthracene	910J	ND	590	530J	ND	680J	860J	1,700J	800J	2,400J	Not available	1,000
Benzo(a)pyrene	980J	ND	700	610J	ND	690J	810J	1,400J	790J	2,100J	100	200
Benzo(b)fluoranthene	1,100J	ND	860	670J	ND	790J	860J	1,400J	810J	2,100J	Not available	900
Dibenz(a,h)anthracene	490J	ND	ND	ND	ND	ND	ND	640J	ND	1,000J	Not available	200
Indeno(1,2,3,cd)pyrene	1,400J	ND	ND	690J	ND	780J	820J	1,700J	950J	2,800J	Not available	3,000
Pentachlorophenol	1,000U	990U	1,100U	1,100U	1,100U	1,000U	1,000U	1,100U	1,100U	1,100U	50,000	6,000

	Sampling Location (Cell ID)										ATSDR CV*	MDNR CALM
Contaminant	224	221	218	215	212	209	209 FD	206	203	200		
Benzo(a)anthracene	2,800J	1,900J	1,200J	3,100	1,800	1,200	2,000J	1,600J	4,700	5,600	Not available	1,000
Benzo(a)pyrene	2,900J	1,700J	1,200J	2,500J	2,100J	1,400J	2,200J	1,400J	4,900J	6,700J	100	200
Benzo(b)fluoranthene	3,100J	1,900J	1,200J	2,500J	2,600J	1,800J	2,000J	1,300J	5,800J	8,900J	Not available	900
Dibenz(a,h)anthracene	750J	740J	ND	1,200J	ND	ND	810J	740J	1,200J	1,600J	Not available	200
Indeno(1,2,3,cd)pyrene	2,100J	2,200J	1,100J	3,000J	1,200J	870J	2,100J	1,700J	3,500J	4,600J	Not available	3,000
Pentachlorophenol	1,100U	1,100U	1,000U	1,000U	1,100U	1,000U	1,000U	990U	980U	1,100U	50,000	6,000

*ATSDR CV=ASTDR Comparison Values for Soil. Comparison values are media-specific concentrations that are used by health assessors to select environmental contaminants for further evaluation.

All Values in parts per billion (ppm) or micrograms per kilogram (µg/kg). Values in **bold italics** exceed MDNR CALM levels.

ND=Not Detected; J=Concentrations are estimates.

Table 3

Sediment and Soil Sampling Results, Unnamed Tributary to Prairie Creek
(Selected Analytical Results, August 2003)

	Sampling Location (Cell ID)					ATSDR CV*	MDNR CALM
Contaminant	203	224	236	236 FD	245		
Benzo(a)anthracene	3,300	380U	370U	400U	360U	Not available	1,000
Benzo(a)pyrene	3,500	380U	370U	400U	360U	100	200
Benzo(b)fluoranthene	3,700	380U	370U	400U	360U	Not available	900
Dibenz(a,h)anthracene	2,000U	380U	370U	400U	360U	Not available	200
Indeno(1,2,3,cd)pyrene	2,000	380U	370U	400U	360U	Not available	3,000
Pentachlorophenol	4,900U	960U	930U	990U	990U	50,000	6,000

*ATSDR CV=ASTDR Comparison Values for Soil. Comparison values are media-specific concentrations that are used by health assessors to select environmental contaminants for further evaluation.

All values in parts per billion or µg/kg. Values in **bold italics** exceed MDNR CALM levels.

U=The contaminant was not detected at or above the reporting limit.

Table 4**Surface Water Sampling Results**
(December 2002)

Sample Location	Sampling Date and PCP Concentration			EPA MCL	ATSDR EMEG*
	5/30/02	8/28/02 & 9/12/02	12/12/02		
SW 4	42	250	102	1	10 Inter, Child 40 Inter, Adult
SW 4 duplicate	41	204	86	1	10 Inter, Child 40 Inter, Adult
SW 5	5.8	0.76	3.22	1	10 Inter, Child 40 Inter, Adult
SW-5.5	NA	NA	2.49	1	10 Inter, Child 40 Inter, Adult

All values in parts per billion or µg/L.

Concentrations in **bold** typeface exceed MCL or EMEG values.

NA=Data not available.

*ATSDR EMEG values are categorized by exposure method and by child or adult.

Intermediate exposure =contact that occurs for more than 14 days but less than 1 year.

Table 5

Emerson Electric Water Monitoring Results

(Selected analytical results, December 2003 sampling)

Contaminant	Influent	Effluent	SS-1	SS-2	SS-3	ATSDR MRL	EPA MCL
1,1-Dichloroethane	310 U	0.5 U	1.8 U	0.8 U	0.5 U	Chronic, Oral 9	NA
Cis 1,2-Dichloroethene	130 JB	0.5 U	0.55 J	2.1	0.35 J	Acute, Oral 1,000	70
Ethylbenzene	4,300	0.052 J	5.9	0.84 U	0.034 J	Int, Inh 1,000	700
Toluene	42 J	0.09 J	0.72 J	0.2 JB	0.5 U	Acute, oral 800	1000
Vinyl Chloride	310U	2.6	0.73J	0.34J	0.5U	Chronic, Oral 0.02	2
Xylenes, total	17,000	0.12 J	130	58 B	0.22 J	Int, Oral, 200	10,000
Pentachlorophenol	20 U	20 U	93	70	20 U	Acute, oral 5	1

All values are in parts per billion or µg/L.

NA=Not available.

U=Not detected at reporting limit.

J=Estimated value.

B=Analyte also detected in trip blank (with exception of metals data result is less than reporting limit).

*ATSDR MRL values are categorized by exposure method and duration of exposure. (Inh=inhalation; Oral=orally; Acute=contact that occurs only once or for up to 14 days; Intermediate=contact that occurs for more than 14 days but less than 1 year; Chronic=contact that occurs for more than 1 year.)

Values in **bold** typeface exceed an ATSDR MRL for either acute, intermediate, or chronic exposure.

DHSS PRG=Department of Health and Senior Services Preliminary Remediation Goals for surface water.